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Response of Sugarcane Varieties to Different Levels of Inputs

M. S. Hossain, A. K. M. R. Islam, M. J. Alam, M. K. Rahman and M. L. Kabir

Bangladesh Sugarcane Research Institute

Ishurdi, Pabna, Bangladesh

ABSTRACT

An experiment was carried out at Bangladesh Sugarcane Research Institute (BSRI) farm during 2004-2005 cropping season under irrigated condition to study the performance of sugarcane varieties in different input levels. Fifteen BSRI bred varieties were tested against three input levels such as high, medium and low inputs with different technologies. Data on number of tiller, millable cane and cane yield indicated that high input level technologies had significant positive effect. No significant differences was found between medium and low input levels for tiller and millable cane production but significant difference was observed in cane yield between them and it was due to variation of per stalk weight. High input level produced 26.5% higher number of millable cane and 37.84% higher cane yield over the low input level. Medium input level produced 20.18% higher cane yield than low input level. The highest pol% cane of 13.02 was obtained in low input level followed by medium and high input level respectively. Varieties Isd 20, Isd 29, Isd 31, Isd 32, Isd 33, Isd 34 and Isd 35 performed better in respect of number of tiller, millable cane and yield and pol % than other tested varieties in medium and low input level. The highest BCR was obtained from medium input level whereas the lowest was from high input level. If input investment is a constraint the sugarcane farmers may practice medium input level technologies.

Key words : Sugarcane variety, input level, yield, pol % cane

INTRODUCTION

Sugarcane (*Saccharum officinarum* L) is the major cash cum sugar crop and main source of sugar and gur in Bangladesh but the national average yield is very low compare to other sugarcane growing countries. The underlying reasons behind low productivity are many including improper management and inadequate input supply. Among various inputs of sugarcane production variety, fertilizer, irrigation, cultural practices, pest management, disease management and others contribute 9, 30, 20, 18, 9, 9 and 5% respectively (Tolia, 1989; Yadav, 1990). The use of healthy seed is an important aspect to start a good crop, which goes to successful cane cultivation because most of the sugarcane diseases are seed-borne and transmitted through seed piece (Yadava, 1993). Sugarcane varieties are responding well to heavy fertilization, especially of fertlizer elements. Cane + potato with the full dose of fertilizer for both the crops gave the highest net return and profit. The profit gradually decreased as the rate of fertilizer to cane was reduced (Imam *et al.*, 1987). Available soil moisture at the early stage of the crop tremendously influences the performance of the crop. Insufficient soil moisture causes germination failure, low tiller production and nutrient uptake restricting growth and physical activities of the crop. Banawari lal (1988) noticed that five pre-monsoon irrigations at an interval of 29 days significantly increased the cane yield which was higher by 50 and 38% over two irrigations at 60 and three irrigations at 90 days interval respectively. The loss in cane production due to weed infestation was estimated upto 75% (Singh and Moolani, 1975). Kabir *et al.*, 1998 reported that maximum cane and sugar yield were obtained with two earthing-up (May and June) and a single wrapping as conventional practice and minimum from no earthing-up and tying.

Insect pests caused considerable losses which are estimated to be around 20% in cane yield and 15% in sugar recovery (Avasthy, 1983).

The most important reasons of poor crop yield for sugarcane in Bangladesh are lack of adoption of proper high yielding sugarcane varieties and agronomic practices. Although, a number of high yielding sugarcane varieties have been developed at BSRI but they could not produce satisfactory yield in farmers' field. The farmers of this country are not economically sound and they can not afford the full input and technologies are needed for cane cultivation. Therefore, screening sugarcane varieties suitable in different level of inputs is essential for higher productivity with appropriate economic investment. So, the experiment was undertaken to find out suitable sugarcane varieties which can grow under different input levels and to evaluate the performance of BSRI bred sugarcane varieties on the yield and economy under different growing conditions.

MATERIALS AND METHODS

The experiment was conducted at Bangladesh Sugarcane Research Institute (BSRI) farm, Ishurdi, Pabna during 2004-2005 cropping season. The site represents High Ganges River Floodplain under Agro-ecological Zone-11. The soil of the experimental site is sandy loam with medium high land. In this experiment fifteen BSRI bred sugarcane varieties were tested under three input levels aim at high, medium and low yield goal to find the suitable sugarcane varieties under different input levels and to evaluate the performance of BSRI bred sugarcane varieties on yield and economy under different growing conditions. The experiment was laid out in split plot design with three replications. The unit plot size was 12 m × 4 m and the treatment factors were as follows:

Factor A : Input levels

1 : High input level
2 : Medium input level
3 : Low input level

High input includes:

1) Mechanical land preparation and planting in trench
2) Certified seed cane
3) Use latest recommended dose of fertilizer for high yield goal
4) Use of pesticide as per recommendation with mechanical pest control
5) Recommended intercultural operation
6) Recommended irrigation (5 times) with proper drainage facilities
7) Tying and earthing up of cane
8) Row spacing 100 cm.
9) Method of planting : Single budded soil bed settlings

Medium input includes:

1) Land preparation by country plough and trench by double furrowing
2) Certified seed cane
3) Use recommended dose of fertilizer for medium yield goal

4) Only mechanical pest control
5) Medium cultural practices
6) Spacing 100 cm
7) Irrigation (3 times)
8) Method of planting: Single budded soil bed settlings

Low input includes:

1) Land preparation by country plough and planting cane in plough furrow
2) Commercial seed cane as seed source
3) Use of fertilizer for low yield goal
4) Cultural operations as per farmers' practice
5) Only live irrigation for settling establishment
6) Spacing 100 cm
7) Method of planting: Single budded soil bed settlings

Factor B : Sugarcane variety (V):

V_1 : Isd 16	V_6 : Isd 28	V_{11} : Isd 33
V_2 : Isd 20	V_7 : Isd 29	V_{12} : Isd 34
V_3 : Isd 22	V_8 : Isd 30	V_{13} : Isd 35
V_4 : Isd 25	V_9 : Isd 31	V_{14} : Isd 36
V_5 : Isd 26	V_{10} : Isd 32	V_{15} : Amrita

Single budded soil bed settlings of each variety were planted in each plot during mid November, 2004. Cane planting was done in trenches/furrows at row distance of 100 cm and plant to plant distance 30 cm. For high yield goal, plots were fertilized with Urea, TSP, MP and Gypsum @ 347, 244, 184 and 222 kg ha^{-1} respectively (BARC, 1997). All TSP, Gypsum and one third ($1/3^{rd}$) of MP were applied in trench as basal dose. The first dose of Urea ($1/3^{rd}$) was applied at 21 days after transplanting (DAT). The second and final dose of rest Urea and MP were applied in two splits at 90 and 150 DAT. To control insect pests, Furadan 5G was applied @ of 40 kg ha^{-1} along with mechanical practices. Irrigation was applied 5 times and other intercultural operations like weeding, mulching, earthing-up, tying etc. were done in time as per recommendation. For medium yield goal, amount of fertilizer was half of high yield goal and application method was same. To control insect pest only mechanical approaches were followed. Irrigation was applied in 3 times and other intercultural operations were done as said in medium input level. For low yield goal, amount of fertilizer was one fourth of high yield goal and applied as basal dose. Only live irrigation was applied for settlings establishment. Insect pest control and other intercultural operations were done as farmers' practice. Collection of data on yield and various yield contributing parameters of cane was done. Tiller population was recorded at 90, 120, 150 and 180 DAT. Millable cane, pol % cane and yield were recorded at harvest. Economic and statistical analysis on different parameters was done following the standard procedures.

RESULTS AND DISCUSSION

Tiller and millable cane production

Significant effect on tiller and millable cane production was found in different input level technologies (Table 1 & 2). From the mean value the maximum tiller population of 183.06 x 10^3 ha^{-1} was found from high input applied plots and lower from medium and low input levels. There were no significant differences between medium and low input levels. Among the tested varieties Isd 33, Isd 31, Isd 34, Isd 29, Isd 32, Isd 35, and Isd 20 performed better than other varieties in

medium and low input level. Data on millable cane production indicated that high input level technology had significant positive effect on the number of millable cane production followed by medium and low input level. Almost identical number of millable canes was obtained from medium and low input level. High input level gave 26.5% higher number of millable cane over the low input level. Variety Isd 33, Isd 31, Isd 34, Isd 29, Isd 32, Isd 35 and Isd 20 were also performed better in millable cane production than other tested varieties in medium and low input level (Table 1).

Table 1. Effect of different input levels on tiller and millable cane production. BSRI, 2004-2005.

Treatments	Tiller (x 10^3 ha^{-1})				Millable cane (x 10^3 ha^{-1})				Conversion % of tiller into millable cane (mean)
	Input level			Mean	Input level			Mean	
	High	Medium	Low		High	Medium	Low		
Isd 16	178.72	104.47	106.39	129.89	86.81	66.11	53.89	68.93	53.07
Isd 20	190.12	115.21	122.39	142.57	94.58	75.00	60.26	76.61	54.00
Isd 22	185.07	129.51	93.46	136.01	86.36	72.21	63.06	73.87	53.00
Isd 25	185.43	89.86	125.37	133.55	94.73	59.59	57.28	70.53	42.00
Isd 26	175.53	90.21	83.94	116.56	66.60	39.31	40.14	48.68	48.00
Isd 28	194.96	132.67	124.09	150.60	91.81	58.33	68.12	72.75	52.00
Isd 29	179.11	106.43	130.36	138.63	80.42	62.22	73.06	71.90	52.00
Isd 30	179.37	83.08	114.58	125.67	82.55	50.61	61.53	64.89	48.00
Isd 31	175.44	161.53	152.06	163.01	80.28	79.58	74.86	78.24	52.00
Isd 32	176.52	133.60	123.11	144.41	84.02	76.53	64.31	74.95	53.00
Isd 33	189.63	146.13	156.67	164.14	91.94	89.17	78.89	86.66	74.00
Isd 34	191.12	113.00	148.93	117.01	94.72	92.64	70.97	86.11	58.00
Isd 35	185.60	132.48	118.86	145.64	89.57	98.88	66.94	85.13	52.00
Isd 36	182.82	153.45	107.04	147.77	92.50	76.52	63.47	77.49	50.00
Amrita	176.55	127.00	115.32	139.62	83.89	66.11	59.30	69.77	52.00
Mean	183.06	121.24	121.50	-	86.78	70.85	63.74	-	-
LSD (5%)	31.52			-	17.33			-	-

Cane yield

Significant differences were found in cane production in different input levels. The maximum mean cane yield of 63.63 t ha^{-1} was obtained from high input level followed by medium input level (Table 3) and the lowest (39.55 t ha^{-1}) from low input level. No significant differences was found between medium and low input levels for tiller and millable cane production but in cane yield significant difference was observed between them it was due to variation of per stalk weight. High input level produced 22.13 and 37.84% higher cane yield over medium and low input level respectively and medium input level produced 20.18% higher cane yield than low input level. Among the tested varieties Isd 33, Isd 31, Isd 34, Isd 29, Isd 32, Isd 35 and Isd 20 also performed better in cane yield production than other varieties in medium and low input level (Table 2).

Pol % cane

Significant effect was found in pol % cane. From the mean value the highest pol % cane of 13.02 was obtained in low input level followed by 11.97 and 11.70 in medium and high input level respectively (Table 3). In medium and high input level pol % cane was identical. Ramesh and Sumamsusan, 2003 reported that application of excess quantities of N, P and K fertilizers have a negative influence on the juice quality parameters of sugarcane and the juice characters are influenced more by genetic make up of the variety. Table 1 represented that variety Isd 16, Isd 20, Isd 26, Isd 29, Isd 31, Isd 33 and Isd 35 performed better in low input level.

Table 2. Effect of different input levels on cane yield and pol % cane. BSRI, 2004-2005.

Varieties	Cane yield (t ha^{-1})				Pol % cane			
	Input level			Mean	Input level			Mean
	High	Medium	Low		High	Medium	Low	
Isd 16	54.58	43.33	26.11	41.34	14.06	12.60	13.65	13.43
Isd 20	62.50	48.89	42.08	51.15	11.78	12.48	12.28	12.18
Isd 22	70.00	46.83	40.14	52.32	11.65	12.51	12.77	12.31
Isd 25	46.50	30.69	31.39	36.19	11.51	11.82	13.02	12.11
Isd 26	40.86	29.86	25.56	31.99	12.85	12.53	13.33	12.90
Isd 28	63.75	37.50	38.61	46.62	12.86	13.21	13.38	13.15
Isd 29	61.52	45.28	34.72	47.18	11.87	12.38	12.70	12.31
Isd 30	42.91	30.56	33.61	35.69	12.60	11.89	13.20	12.56
Isd 31	91.38	64.72	52.22	69.44	11.72	11.64	13.57	12.31
Isd 32	70.42	71.39	54.03	65.28	10.27	11.53	12.55	11.45
Isd 33	75.69	72.92	46.30	64.97	11.09	11.93	13.55	12.19
Isd 34	58.75	62.50	51.39	57.54	9.45	10.83	11.96	10.74
Isd 35	67.50	54.30	46.39	56.06	12.62	12.60	13.63	12.95
Isd 36	77.64	58.33	37.71	57.89	12.76	13.15	13.35	13.08
Amrita	69.44	46.11	33.05	49.53	9.43	8.40	12.29	10.04
Mean	63.63	49.55	39.55	-	11.77	11.97	13.02	-
LSD (5%)	-			8.97	-			-

Table 3. Effect of different input levels on cane yield and pol % cane. BSRI, 2004-2005.

Parameters	Input level			LSD (5%)
	High	Medium	Low	
Tiller (x 10^3 ha^{-1})	183.06	121.24	121.50	7.33
Millable cane (x 10^3 ha^{-1})	86.78	70.85	63.74	13.70
Cane yield (t ha^{-1})	63.63	49.55	39.55	10.09
Pol % cane	11.70	11.97	13.02	0.62

Table 4. Initial and post harvest soil test value of the experimental field. BSRI, 2004-2005.

Input level	pH		N %		P (ppm)		K (meq %)		S (ppm)	
	Initial	Post harvest	Initial	Post harvest	Initial	Post harvest	Initial	Post harvest	Initial	Post harvest
High	7.79	7.75	0.062	0.062	13.1	10.2	0.22	0.30	13.9	11.6
Medium	7.78	7.78	0.061	0.058	11.5	9.4	0.22	0.26	13.9	13.7
Low	7.77	7.69	0.059	0.046	11.0	8.0	0.22	0.22	14.3	13.1

Table 5. Economics and benefit cost ratio (BCR) under different input levels. BSRI, 2004-2005.

Input level	Total production cost (Tk. ha^{-1})	Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
High	42,500	81,828.18	39,328.18	1.92
Medium	30,000	63,721.30	33,721.30	2.12
Low	24,500	50,861.30	26,361.30	2.07

Cost analysis indicated that highest cost was involved in high input level whereas lowest cost was required for low input level. The highest gross return and gross margin were obtained from high input level followed by medium and low input level. But in case of benefit cost ratio (BCR) the highest BCR was obtained from medium input level whereas the lowest was from high input level. The results indicated that in input investment is a constraint, the sugarcane farmers may practice medium input level technologies. The overall result revealed that high input technologies had significant positive effect on number of tiller, millalble cane and cane yield and sugar production. Tiller, millable cane production and pol % cane were identical between medium and low input levels but significant difference was observed in cane yield. Variety Isd 20, Isd 29, Isd 31, Isd 32, Isd 33, Isd 34 and Isd 35 performed better in respect of number of tiller, millable cane and yield and pol % cane than other tested varieties in medium and low input level.

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